

IN THE CLAIMS

*Please amend claims 1-9; 12-16; and 24-27; cancel claims 14-15 and 21-23; and add new claims 29-41, as follows:*

What is claimed is:

1. (Currently Amended) A system, comprising:

a first executing process that:

implements a first continuous-time model to simulate a first subsystem, the first model being programmed in a first language and having a first state variable; and

sends a first series of state-related messages numerical values, each message numerical value reflecting information relating to the value of the first state variable at a different point  $t_m$  in simulation time in the first model; and

a second executing process that:

receives said first series of state-related messages numerical values; and implements a second continuous-time model to simulate a second subsystem, the second model being programmed in a second language and taking as an input the value of the first state variable from said first series of state-related messages numerical values.

2. (Currently Amended) The system of claim 1, wherein:

the second model has a second state variable;

said second process further sends a second series of state-related messages numerical values, each message numerical value reflecting information relating to the value of the second state variable at a different point  $t_n$  in simulation time in the first model;

said first process further receives said second series of state-related messages numerical values; and

the first model takes as an input the value of the second state variable from said second series of state-related messages numerical values.

3. (Currently Amended) The system of claim 2, wherein for at least a first message numerical value in said first series of state-related messages numerical values, said first message numerical value reflecting information relating to the value of the first state variable at point  $t_1$  in simulation time in the first model, there is a second message numerical value in said second series of state-related messages numerical values that reflects the value of the second state variable at point  $t_1$  in simulation time in the first model.

4. (Currently Amended) The system of claim 2, wherein for at least a first message numerical value in a series of state-related messages numerical values, said first message numerical value reflecting the value of the first state variable at point  $t_1$  in simulation time, there is no second message numerical value in said second series of state-related messages numerical values that reflects the value of the second state variable at point  $t_1$  in simulation time.

5. (Currently Amended) The system of claim 1, wherein:

said first series of state-related messages numerical values comprises  
a first message numerical value reflecting information relating to the value of  
the first state variable at time  $t_1$  in simulation time in the first model;  
a second message numerical value reflecting information relating to the value  
of the first state variable at time  $t_2$  in simulation time in the first model; and

a third message numerical value reflecting information relating to the value of the first state variable at time  $t_3$  in simulation time in the first model; and wherein the first message numerical value, second message numerical value, and third message numerical value are consecutive within said first series of state-related messages numerical values; and  $t_2-t_1 = t_3-t_2$ .

6. (Currently Amended) The system of claim 1, wherein:

said first series of state-related messages numerical values comprises  
a first message numerical value reflecting information relating to the value of the first state variable at time  $t_1$  in simulation time in the first model;  
a second message numerical value reflecting information relating to the value of the first state variable at time  $t_2$  in simulation time in the first model; and  
a third message numerical value reflecting information relating to the value of the first state variable at time  $t_3$  in simulation time in the first model; and wherein the first message numerical value, second message numerical value, and third message numerical value are consecutive within said first series of state-related messages; and  $t_2-t_1 \neq t_3-t_2$ .

7. (Currently Amended) The system of claim 1, wherein:

said first set of programming instructions executing process exposes a first interface for the first model, where said first interface:  
prevents access by said second set of programming instructions executing process to a first substantial portion of the first model, and

allows access by said second set of programming instructions executing process to a second substantial portion of the first model; and said second set of programming instructions executing process exposes a second interface for the second model, where said second interface:

prevents access by said first set of programming instructions executing process to a first substantial portion of the second model, and allows access by said first set of programming instructions executing process to a second substantial portion of the second model.

8. (Currently Amended) The system of claim 1, wherein

the first model has a third state variable;  
each message numerical value in said first series of state-related messages numerical values further reflects information relating to the value of the third state-variable at point  $t_m$  in simulation time; and

the second model also takes the third state variable as an input from said first series of state-related messages numerical values.

9. (Currently Amended) A method for simulating operation of a physical system having a plurality of physical subsystems, comprising:

simulating a first physical subsystem with a first continuous-time simulation;  
accepting a request for export of information relating to a number  $n$  of state-related variables that characterize the state of the first physical subsystem in said simulating;  
sending a first series of state-related messages, each message containing information relating to the value of at least one of the  $n$  state-related variables; and

simulating a second physical subsystem with a second continuous-time simulation; wherein:  
~~the request is made in conjunction with said simulating a second physical subsystem;~~  
the first physical subsystem interacts with the second physical subsystem; and  
the at least one state-related variable characterizes at least a portion of the interaction  
between the first physical subsystem and the second physical subsystem.

10. (Original) The method of claim 9, wherein:

said simulating a first physical subsystem is performed on a first processor, and  
said simulating a second physical subsystem is performed on the first processor.

11. (Original) The method of claim 9, wherein:

said simulating a first physical subsystem is performed on a first processor, and  
said simulating a second physical subsystem is performed on a second processor.

12. (Currently Amended) The method of claim 9, wherein the number n is at least two.

13. (Currently Amended) The method of claim 12, wherein the number n is at least four.

14. - 15. (Cancelled)

16. (Currently Amended) The method of claim [[15]] 12, further comprising sending a third  
series of state-related messages numerical values, wherein:

at least one numerical value in the first series of state-related numerical values contains  
information relating to the values of a first proper subset of the set containing all n state-related  
variables;

at least one ~~message numerical value~~ in the third series of state-related ~~messages numerical values~~ contains information relating to the values of a second proper subset of the set containing all  $n$  state variables, and  
the second proper subset is different from the first proper subset.

17. (Currently Amended) The method of claim 16, wherein:

the messages in the first series of state-related ~~messages numerical values~~ are sampled at a first rate in simulation time in the first model;  
the ~~messages numerical values~~ in the third series of state-related ~~messages numerical values~~ are sampled at a second rate in simulation time in the first model; and  
the first rate and the second rate are not equal.

18. (Currently Amended) The method of claim 16, wherein:

the ~~messages numerical values~~ in the first series of state-related ~~messages numerical values~~ are sampled at a first rate in simulation time in the first model;  
the ~~messages numerical values~~ in the third series of state-related ~~messages numerical values~~ are sampled at a second rate in simulation time in the first model; and  
the first rate and the second rate are equal.

19. (Currently Amended) The method of claim 9, wherein:

a given process makes the request; and  
said sending directs the first series of state-related ~~messages numerical values~~ to a process different from the given process.

20. (Currently Amended) The method of claim 9, further comprising:

receiving the first series of state-related messages numerical values in a first output process in communication with a first output device; and

sending to the first output device a first set of information carried by a plurality of messages numerical values in the first series of state-related messages numerical values; and  
wherein the first output device is in communication with the first output process.

21. - 23. (Cancelled)

24. (Currently Amended) The system method of claim 20, wherein said displaying comprises graphing a function of the first state-related variable versus time an independent variable.

25. (Currently Amended) The method of claim 20, further comprising:

receiving a second series of state-related messages numerical values in the first output process; and

sending to the first output device a second set of information carried represented by a plurality of messages numerical values in the second series of state-related messages numerical values; and

wherein said sending steps comprise outputting time information associating the first set of information and the second set of information with a system time.

26. (Currently Amended) The method of claim 20, further comprising:

receiving a second series of state-related messages numerical values in a second output process, which is in communication with a second output device; and

outputting to the second output device a second set of information carried by a plurality of messages numerical values in the second series of state-related messages numerical values; wherein said sending comprises associating the first set of information with a system time; and

said outputting comprises associating the second set of information with the system time an independent variable.

27. (Currently Amended) A system, comprising:

a first computer-readable medium encoded with programming instructions executable in a first process to:

implement a first continuous-time simulation model solved with a numerical solver;

accept a first command signal; and

manage the first simulation model based on the first command signal;

a second computer-readable medium encoded with a second set of programming instructions executable in a second process to:

implement a second continuous-time simulation model solved with a numerical solver;

accept a second command signal; and

manage the second simulation model based on the second command signal;

and

a third computer-readable medium encoded with a third set of programming instructions executable in a third process to:

send the first command signal to said first process; and

send the second command signal to said second process.

28. (Original) The system of claim 27, wherein said managing steps are synchronized to a common system time.

29. (New) [1, with state-space model] The system of claim 1, wherein the first model is a state-space model.

30. (New) [1, with resistor-companion model] The system of claim 1, wherein the first model is a resistor-companion model.

31. (New) [1, with different solvers] The system of claim 1, wherein:

the implementation of the first continuous-time model uses a first numerical integration technique, and

the implementation of the second continuous-time model uses a second numerical integration technique.

32. (New) [10, but depending from claim 1] The system of claim 1, wherein:

the first executing process and the second executing process are executed on a first processor.

33. (New) [11, but depending from claim 1] The system of claim 1, wherein:

the first executing process is executed on a first processor, and

the second executing process is executed on a second processor.

34. (New) [16, with same destinations] The method of claim 16, wherein:  
the second series of state-related numerical values is sent to a first destination; and  
the third series of state-related numerical values is sent to the first destination.

35. (New) [16, with different destinations] The method of claim 16, wherein:  
the second series of state-related numerical values is sent to a first destination; and  
the third series of state-related numerical values is sent to a second destination.

36. (New) [24, graph v. time] The system of claim 24, wherein the independent variable is time.

37. (New) [24, graph v. state variable of same subsystem] The system of claim 24, wherein the independent variable is one of the  $n$  state-related variables.

38. (New) [24, graph v. state variable of other subsystem] The system of claim 24, wherein the independent variable is a state-related variable in the simulation of the second physical subsystem.

39. (New) [>=1 subsystem is ODE] A computing system for simulating a physical system, the physical system comprising two or more subsystems, the computing system comprising a plurality of computing devices, each simulating a subsystem of the physical system, wherein:  
at least one subsystem is simulated by computationally solving a system of ordinary differential equations;  
each subsystem simulation either

provides a series of output messages to another subsystem simulation, where the output messages encode state-related data from the subsystem, or receives a series of input messages from another subsystem simulation, where the input messages encode state-related data from the other subsystem simulation, or both provides a series of output messages to another subsystem simulation, where the output messages encode state-related data from the subsystem, and receives a series of input messages from another subsystem simulation, where the input messages encode state-related data from the other subsystem simulation; and the computing system provides an output signal from at least one of the subsystem simulations.

40. (New) [> $O(n)$  speed increase from division of problem] In a distributed simulation of a physical system, the improvement comprising:

running a continuous-time simulation of the physical system in a set of  $n$  computing devices; wherein the running occurs with a speed greater than  $O(n)$  times the speed of the simulation using a single one of the computing devices.

41. (New) [... better than  $O(n^2)$ ] The system of claim 40, wherein the running occurs with a speed greater than  $O(n^2)$  times the speed of the simulation using a single one of the computing devices.

42. (New) [... better than  $O(n^3)$ ] The system of claim 40, wherein the running occurs with a speed that is at least  $O(n^3)$  times the speed of the simulation using a single one of the computing devices.